

CLAIMS

The following listing of the claims replaces all prior versions, and listings, of the claims in the application. No Amendments are made herein.

1. (Previously Presented) An isotropic pitch-based carbon fiber spun yarn fabric produced by a process characterized by comprising:
winding a water-soluble polymer fiber around a surface of an isotropic pitch-based carbon fiber spun yarn to form a composite yarn;
weaving the composite yarn to form a composite yarn fabric; and
dissolving and removing the water-soluble polymer fiber from the composite yarn fabric, wherein the water-soluble polymer fiber comprises:
a first water-soluble polymer fiber wound around the surface of the spun yarn by twisting the first water-soluble polymer fiber in a first direction with gaps provided between the fibers; and
a second water-soluble polymer fiber wound around the surface of the spun yarn by twisting a second water-soluble polymer fiber in the second direction opposite to the first direction with gaps provided between the fibers.

2. (Original) The isotropic pitch-based carbon fiber spun yarn fabric according to Claim 1, wherein the composite yarn further comprises a sizing agent layer formed on the surface of the spun yarn, and isotropic pitch-based carbon fiber spun yarn fabric being produced by the process characterized further comprising:

dissolving and removing the water-soluble polymer fiber and the sizing agent from the composite yarn fabric.

3. (Canceled).

4. (Original) The isotropic pitch-based carbon fiber spun yarn fabric according to claim 1, wherein the water-soluble polymer fiber is a water-soluble vinylon fiber.

5. (Original) The isotropic pitch-based carbon fiber spun yarn fabric according to claim 1, wherein the isotropic pitch-based carbon fiber spun yarn contains fine carbon fiber aggregates having a maximum diameter equal to or below 3.0 times an average diameter of foundation yarn of the spun yarn and a maximum length equal to or below 10 mm.

6. (Original) The isotropic pitch-based carbon fiber spun yarn fabric according to claim 5, wherein the isotropic pitch-based carbon fiber spun yarn satisfies an abundance ratio of the fine carbon fiber aggregates contained in the isotropic pitch-based carbon fiber spun yarn, which is equal to or below 3 pieces per 10 m, the fine carbon fiber aggregates having the maximum diameter in a range of 1.5 to 3.0 times the average diameter of the foundation yarn of the spun yarn and the maximum length in a range of 3 to 10 mm.

7. (Previously Presented) A method of manufacturing an isotropic pitch-based carbon fiber spun yarn fabric, comprising the steps of:

obtaining composite yarn by winding a water-soluble polymer fiber around a surface of isotropic pitch-based carbon fiber spun yarn;

obtaining a composite yarn fabric by weaving the composite yarn; and

obtaining the isotropic pitch-based carbon fiber spun yarn fabric by dissolving and removing the water-soluble polymer fiber from the composite yarn fabric, wherein the step of obtaining the composite yarn comprises:

winding a first water-soluble polymer fiber wound around the surface of the spun yarn by twisting the first water-soluble polymer fiber in a first direction with gaps provided between the fibers; and

winding a second water-soluble polymer fiber around the surface of the spun yarn by twisting a second water-soluble polymer fiber in the second direction opposite to the first direction with gaps provided between the fibers.

8. (Original) The method of manufacturing the isotropic pitch-based carbon fiber spun yarn fabric according to claim 7, further comprising the step of:

forming a sizing agent layer by applying and then drying a sizing agent aqueous solution onto the surface of the spun yarn,

the step of obtaining the isotropic pitch-based carbon fiber spun yarn fabric, characterized in that the water-soluble polymer fiber and the sizing agent are dissolved and removed from the composite yarn fabric in the step of obtaining the isotropic pitch-based carbon fiber spun yarn fabric.

9. (Canceled).

10. (Original) The method of manufacturing the isotropic pitch-based carbon fiber spun yarn fabric according to claim 7, wherein the water-soluble polymer fiber is a water-soluble vinylon fiber.

11. (Original) The method of manufacturing the isotropic pitch-based carbon fiber spun yarn fabric according to claim 7, further comprising the step of:

removing fine carbon fibers and aggregates thereof from the isotropic pitch-based carbon fiber spun yarn and thus obtaining the spun yarn containing the fine carbon fiber aggregates having a maximum diameter equal to or below 3.0 times an average diameter of foundation yarn of the spun yarn and a maximum length equal to or below 10 mm.

12. (Original) The method of manufacturing the isotropic pitch-based carbon fiber spun yarn fabric according to claim 11, wherein the isotropic pitch-based carbon fiber spun yarn obtained in the foregoing step satisfies an abundance ratio of the fine carbon fiber aggregates contained in the spun yarn, which is equal to or below 3 pieces per 10 m, the fine carbon fiber aggregates having the maximum diameter in a range of 1.5 to 3.0 times the average diameter of the foundation yarn of the spun yarn and the maximum length in a range of 3 to 10 mm.

13. (Original) The method of manufacturing the isotropic pitch-based carbon fiber spun yarn fabric according to claim 11, the foregoing step is at least one process selected from the group consisting of the following (a) to (d):

(a) a process of allowing the spun yarn to contact a roller rotating in the same direction as a traveling direction of the spun yarn at a circumferential velocity equal to or greater than a feeding velocity of the spun yarn;

(b) a process of blowing an air flow over the spun yarn;

(c) a process of washing the spun yarn with water; and

(d) a process of washing the spun yarn with water while applying an ultrasonic wave.

14. (Previously Presented) A composite yarn comprising:
isotropic pitch-based carbon fiber spun yarn; and
a water-soluble polymer fiber wound around a surface of the spun yarn, wherein the water-soluble polymer fiber comprises:
a first water-soluble polymer fiber wound around the surface of the spun yarn by twisting the first water-soluble polymer fiber in a first direction with gaps provided between the fibers; and
a second water-soluble polymer fiber wound around the surface of the spun yarn by twisting a second water-soluble polymer fiber in the second direction opposite to the first direction with gaps provided between the fibers.
15. (Original) The composite yarn according to claim 14, further comprising:
a sizing agent layer formed on the surface of the spun yarn.
16. (Canceled).
17. (Original) The composite yarn according to claim 14, wherein the water-soluble polymer fiber is a water soluble vinylon fiber.
18. (Original) The composite yarn according to claim 14, wherein the isotropic pitch-based carbon fiber spun yarn contains fine carbon fiber aggregates having a maximum diameter equal to or below 3.0 times an average diameter of foundation yarn of the spun yarn and a maximum length equal to or below 10 mm.

19. (Original) The composite yarn according to claim 18, wherein the isotropic pitch-based carbon fiber spun yarn satisfies an abundance ratio of the fine carbon fiber aggregates contained in the isotropic pitch-based carbon fiber spun yarn, which is equal to or below 3 pieces per 10 m, the fine carbon fiber aggregates having the maximum diameter in a range of 1.5 to 3.0 times the average diameter of the foundation yarn and the maximum length in a range of 3 to 10 mm.

20. (Original) Isotropic pitch-based carbon fiber spun yarn, wherein fine carbon fiber aggregates, which are contained in the isotropic pitch-based carbon fiber spun yarn, have a maximum diameter equal to or below 3.0 times of an average diameter of foundation yarn of the spun yarn and a maximum length equal to or below 10 mm.

21. (Original) The isotropic pitch-based carbon fiber spun yarn according to claim 20, wherein the isotropic pitch-based carbon fiber spun yarn satisfies an abundance ratio of the fine carbon fiber aggregates contained in the isotropic pitch-based carbon fiber spun yarn, which is equal to or below 3 pieces per 10 m, the fine carbon fiber aggregates having the maximum diameter in a range of 1.5 to 3.0 times the average diameter of the foundation yarn of the spun yarn and the maximum length in a range of 3 to 10 mm.

22. (Original) A method of manufacturing isotropic pitch-based carbon fiber spun yarn comprising the steps of:

removing fine carbon fibers and aggregates thereof by at least one process selected from the group consisting of the following (a) to (d):

(a) a process of allowing the spun yarn to contact a roller rotating in the same direction as a traveling direction of the spun yarn at a circumferential velocity equal to or greater than a feeding velocity of the spun yarn;

(b) a process of blowing an air flow over the spun yarn;

(c) a process of washing the spun yarn with water; and

(d) a process of washing the spun yarn with water while applying an ultrasonic wave, and

obtaining the spun yarn containing the fine carbon fiber aggregates having a maximum diameter equal to or below 3.0 times of an average diameter of foundation yarn of the spun yarn and a maximum length equal to or below 10 mm.

23. (Original) The method of manufacturing the isotropic pitch-based carbon fiber spun yarn according to claim 22, wherein the isotropic pitch-based carbon fiber spun yarn to be obtained satisfies an abundance ratio of the fine carbon fiber aggregates contained in the spun yarn, which is equal to or below 3 pieces per 10 m, the fine carbon fiber aggregates having the maximum diameter in a range of 1.5 to 3.0 times as large as the average diameter of the foundation yarn and the maximum length in a range of 3 to 10 mm.